BACnet OPC Server User's Manual

27 Sunnyside Grove
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Australia

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Introduction

The SCADA Engine BACnet OPC Server is a server that provides data access (DA), Alarms and Events (AE), and Historical Data Access (HDA) between OPC clients and BACnet devices.

The Data Access (DA) server enables interchange of Data from a BACnet device to an OPC Client using the following BACnet services:

- Read Property
- Read Multiple Properties
- Write Property
- Write Multiple Properties
- Change of Value (COV) Notification

The SCADA Engine BACnet OPC Server supports reading and writing of all BACnet properties. This makes it possible to configure the On/Off times in a BACnet Time Schedules as well as all other configurable properties. A device discovery routine automates the creation of OPC Tags based on the BACnet Devices connected to the network. Configuration data is saved offline in a database file which can be exported to CSV format. There are no limits to the number of OPC Tags that can be created in the OPC Server it is restricted by the available memory and CPU of the computer.

The Alarm and Events (AE) server enables interchange of BACnet Alarms from a BACnet device to an OPC Client using the following services:

- Confirmed Event Notification
- Unconfirmed Event Notification
- Acknowledge Alarm

When a BACnet Alarm is received the AE server translates it into an OPC Alarm using the message text received from the BACnet Alarm. If an acknowledgement is required then the Alarm can be acknowledged from an OPC Client.

The Historical Data Access (HDA) server enables interchange of BACnet Trend logs from a BACnet device to an OPC Client using the following services:

- Read Range

OPC Clients can access the (HDA) server using the OPC standard. The trend log data can be stored in an internal database, or in a Microsoft SQL Server database.

A BACnet system consists of a number of devices that connected to a computer network, typically on an Ethernet network, but with the aid of routers the devices can be connected on an RS485 network. Each device has a unique device ID to distinguish it from other devices. The SCADA Engine BACnet OPC Server connects onto the BACnet network as shown in figure 1.

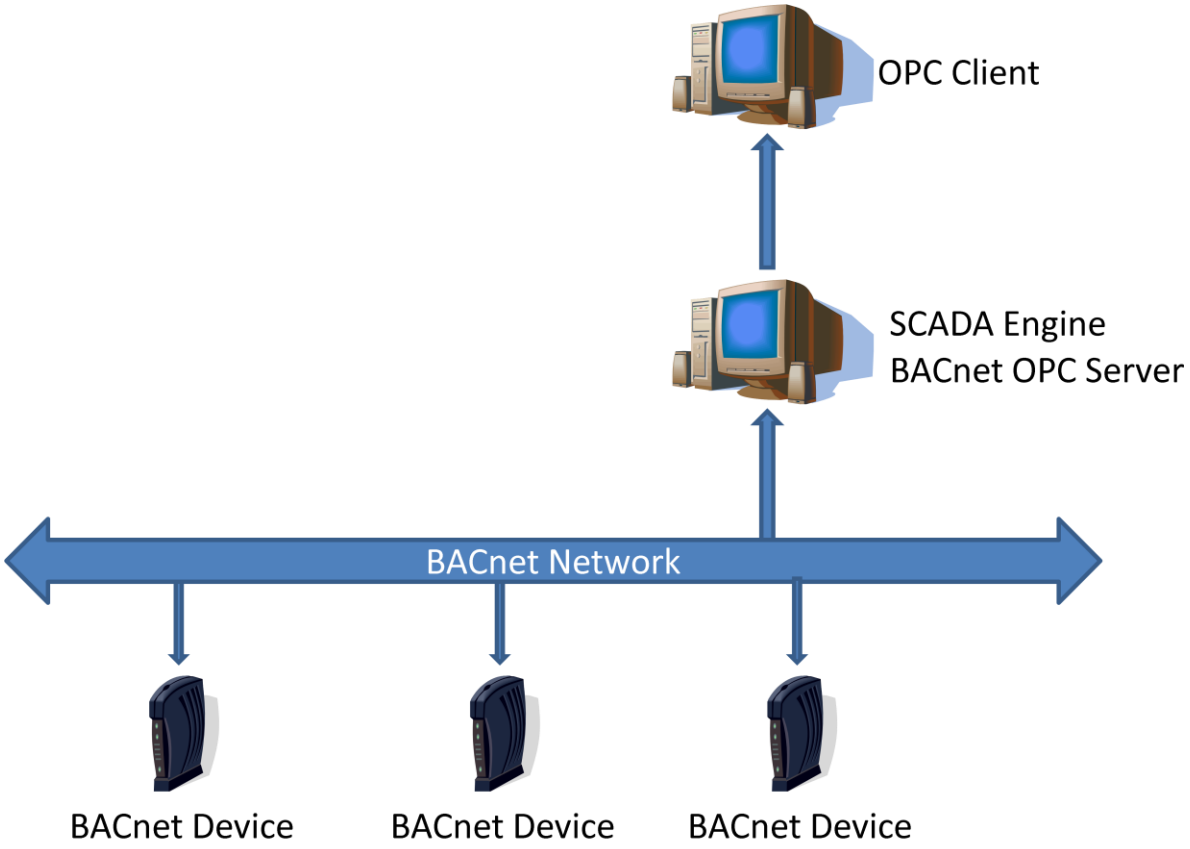


Figure 1 - BACnet Network

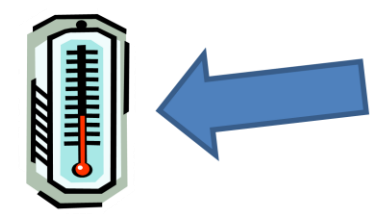
Within each BACnet device information is stored as a collection of objects each with a set of standard properties. The BACnet specification contains a set of standard objects and properties and provides the ability to add to this with proprietary objects and properties. There can be multiple objects of the same type within the same device. The SCADA Engine BACnet OPC Server supports all standard and proprietary objects and properties. The following is a list of standard BACnet Objects.

- Accumulator Object Type
- Analog Input Object Type
- Analog Output Object Type
- Analog Value Object Type
- Averaging Object Type
- Binary Input Object Type
- Binary Output Object Type
- Binary Value Object Type

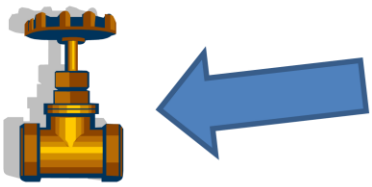
- Calendar Object Type
- Command Object Type
- Device Object Type
- Event Enrollment Object Type
- File Object Type
- Group Object Type
- Life Safety Point Object Type
- Life Safety Zone Object Type
- Loop Object Type
- Multi-state Input Object Type
- Multi-state Output Object Type
- Multi-state Value Object Type
- Notification Class Object Type
- Program Object Type
- Pulse Converter Object Type
- Schedule Object Type
- Trend Log Object Type

The addressing of BACnet data points is made up of the following items:

- Device ID – Uniquely identifies the Device on the BACnet network.
- Object Type – The type of object within the device.
- Object Instance – The Instance number of the object.
- Property ID – The property of the object.
- Array Index – Optional (only available if the data type is an array).



Device ID 101 - Analog Input 1	
Object Name	Room Temp
Present Value	22.5
Units	Celcius



Device ID 101 - Analog Output 1	
Object Name	Heating Valve
Present Value	66
Units	Percent
Priority Array (Index 8)	null

Figure 2 - BACnet Addressing

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Installation

This chapter describes how to install the SCADA BACnet OPC Server onto your PC. It is important that you check the System Requirements section before following the installation section for a step by step guide to the installation process.

System Requirements

The minimum hardware requirements for the BACnet OPC Server are:

- Intel® Pentium® 4 Processor
- 512 MB RAM
- 20 GB hard drive

The SCADA Engine BACnet OPC Server can be used with the following operating systems:

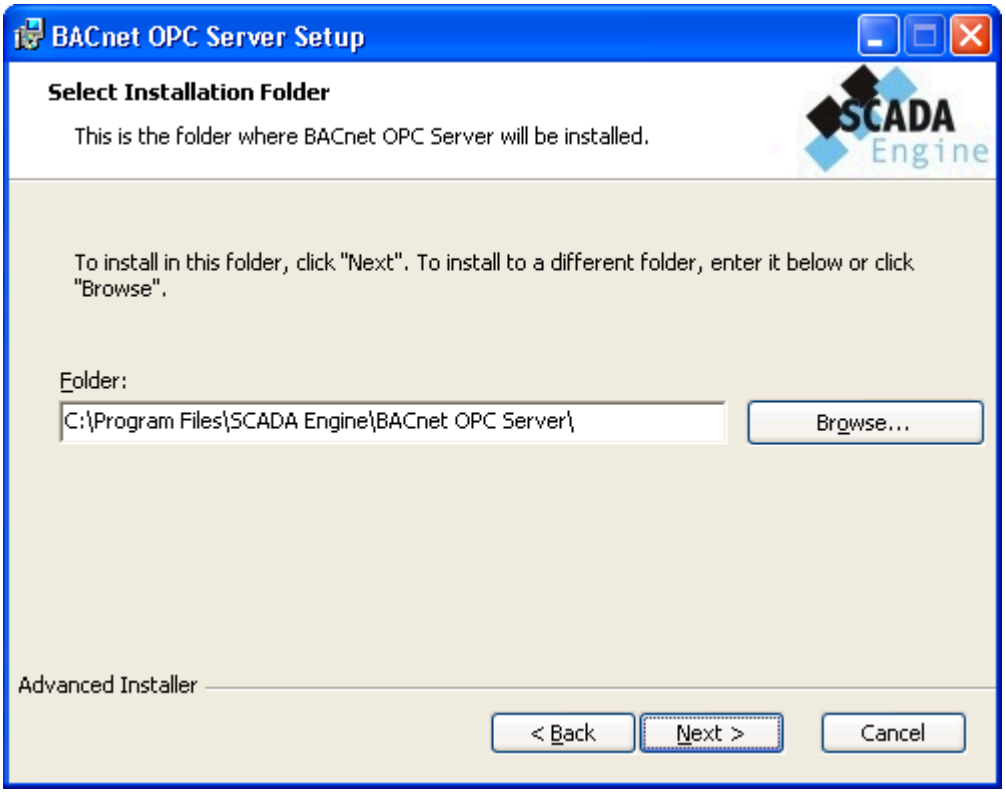
- Microsoft Windows XP
- Microsoft Windows 2003 Server
- Microsoft Windows 2000
- Microsoft Windows Vista
- Microsoft Windows 2008 Server
- Microsoft Windows 7

Install

Log onto the system as Administrator before running the installation program, it cannot be installed under a limited user account.

1. Place the SCADA Engine BACnet OPC Server CD into the CD drive, or double click on the BACnetOPCServer_2.1.x.x.exe program.
2. The Windows Installer will start and you should see the following screen.
3. Click the next button.

4. Select the folder location for installation and then click the next button



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Installed Files

The program files are installed by default into the C:\Program Files\SCADA Engine\BACnet OPC Server directory on the hard drive. The table below lists all of the files installed into this location.

- 25/11/2012 08:44 AM 761 AddressBindings.csv
- 25/11/2012 08:46 AM 9,167 baclog.txt
- 27/01/2013 10:55 AM 2,527,232 BACnAPI.dll
- 10/03/2011 09:21 AM 1,051,031 BACnet OPC Server.chm
- 10/03/2011 09:21 AM 1,976,933 BACnet OPC Server.pdf
- 10/03/2011 09:21 AM 663 BACnetOPCServer.config
- 10/03/2011 09:21 AM 665 BACnetOPCServerUI.config
- 25/11/2012 08:46 AM 1,916 bacnet_status.log
- 10/03/2011 09:20 AM 666 BACnOpcHdaServer.config
- 29/01/2013 10:55 AM 876,544 BACnOpcHdaServer.exe
- 29/01/2013 10:58 AM 987,136 BACnOPCServer.exe
- 29/01/2013 11:03 AM 2,138,112 BACnOPCServerUI.exe
- 29/01/2013 10:42 AM 737,280 BACnSvrTest.exe
- 29/01/2013 02:22 PM <DIR> Dongle
- 22/01/2013 05:02 PM 139,776 dpwin32.dll
- 29/01/2013 02:22 PM <DIR> Language
- 29/01/2013 10:50 AM 1,982,464 log4cxx.dll
- 25/11/2012 08:44 AM 10,198 ObjectOptions.csv
- 26/01/2013 10:11 AM 5,488 OPCTags.csv
- 25/11/2012 08:49 AM 536 scada_engine.lic
- 29/01/2013 02:23 PM 0 test.txt
- 10/03/2011 09:21 AM 440,557 WinPcap_3_0.exe
- 29/01/2013 10:41 AM 311,296 WtOPCSvr.dll

Application Data

Application data is stored onto the hard drive into the C:\Documents and Settings\All Users\Application Data\SCADA Engine\BACnet OPC Server directory for Windows 2000, 2003 and XP. It is stored into C:\ProgramData\SCADA Engine\BACnet OPC Server for Vista and Windows 7.

A database file is used to store OPC configuration data and log files are stored in the logging directories.

Uninstall

To remove the BACnet OPC Server, go to the Control Panel and select Add/Remove programs. Locate the entry for the BACnet OPC server and remove it.

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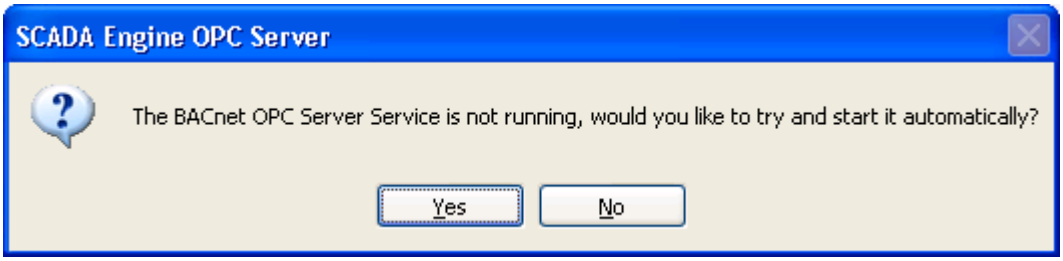
Getting Started

This section contains a tutorial with a step by step walk through of the automated configuration process. This tutorial explains what you may need to configure in order to get your BACnet OPC Server up and running.

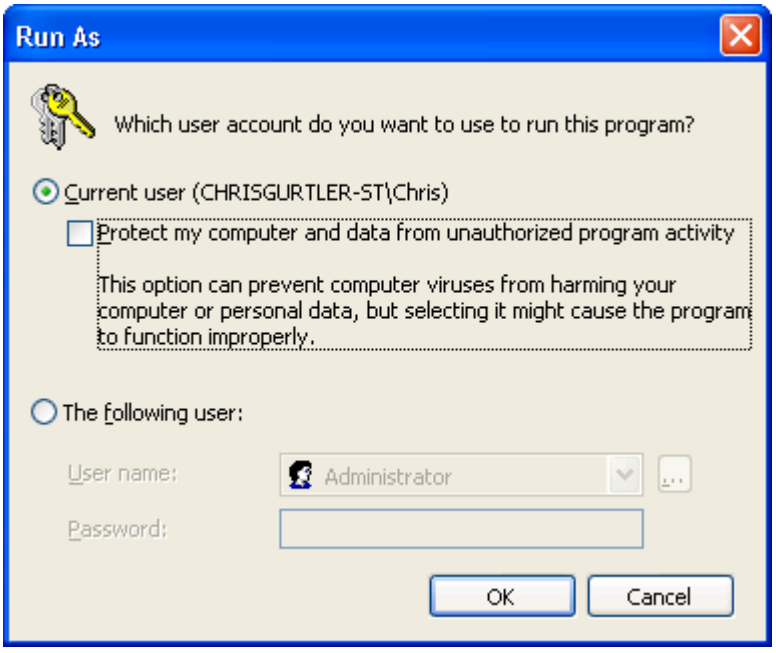
Start the BACnet OPC Server

From the Start Menu select "SCADA Engine – BACnet OPC Server – BACnet OPC Server" to start the SCADA BACnet OPC Server. You may see the following dialog box if the BACnet OPC Server service is not running.



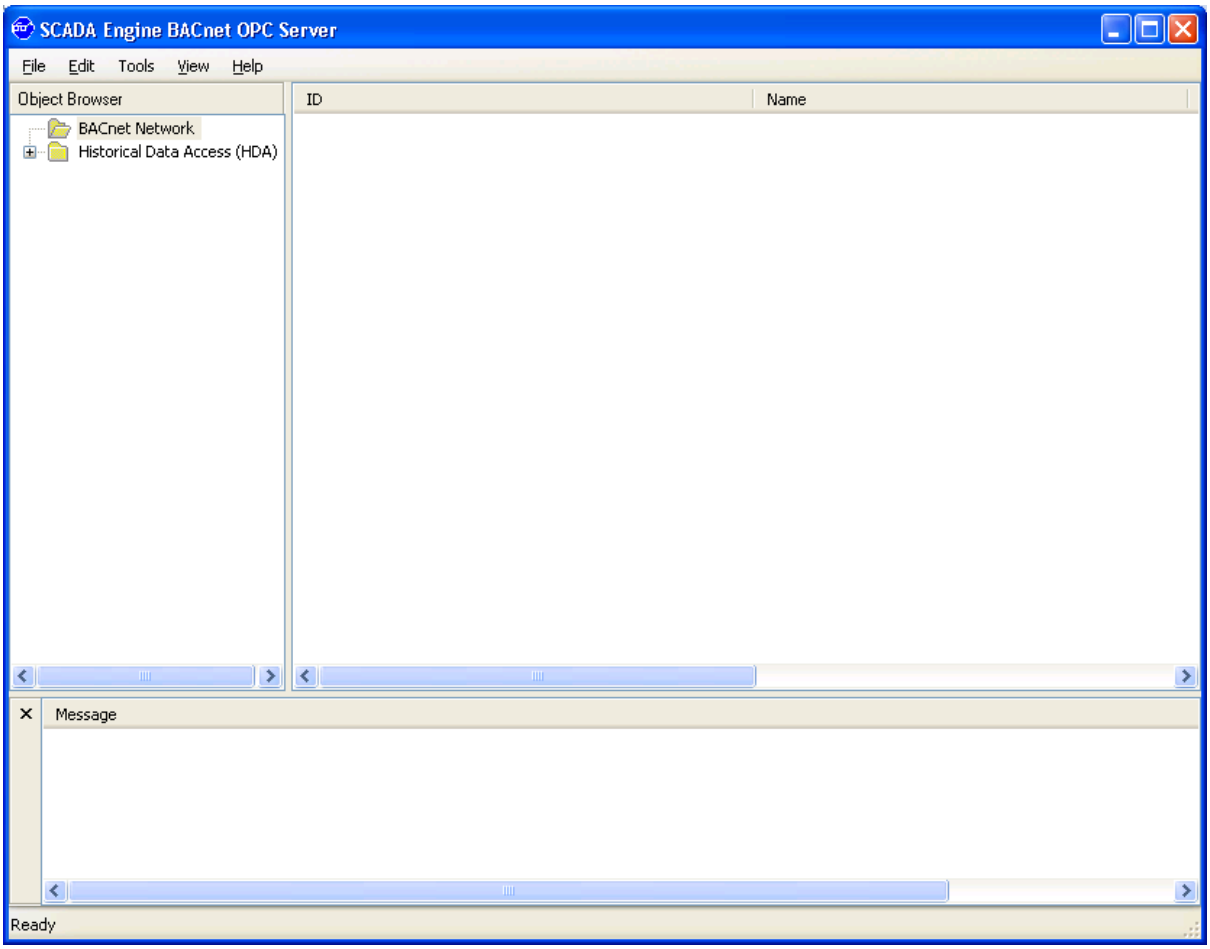
Select yes if you would like the application to start the Service, otherwise go to the control panel and start the service manually.

On Windows XP you may see the following dialog. You will need to Uncheck the option "Protect My Computer"



After the Service has started you will see a registration dialog like the one below to indicate that the application is running in evaluation mode. If you do not have a registration code and you are evaluating the software then you will need to visit the website at http://www.scadaengine.com/evaluation_codes.html to obtain an evaluation code. Otherwise you can select the “Online” radio button to download an evaluation code automatically.

If the application starts without error then you should see the following dialog box. There should be no errors in the message window.



If there were problems starting the SCADA Engine BACnet OPC Server, then you should see some errors in the message window. The most common error occurs when you are running another BACnet application on the same PC as the SCADA Engine BACnet OPC Server. When this happens you may get the following error:

- Error in BACnet Server could not start driver - Only one usage of each socket address (protocol/network address/port) is normally permitted.

This may happen if you are running the Cimetrics BACnet stack, or any other software that uses BACnet port 47808. In this case you will need to disable the Cimetrics BACnet stack which can be done from services in the control panel.

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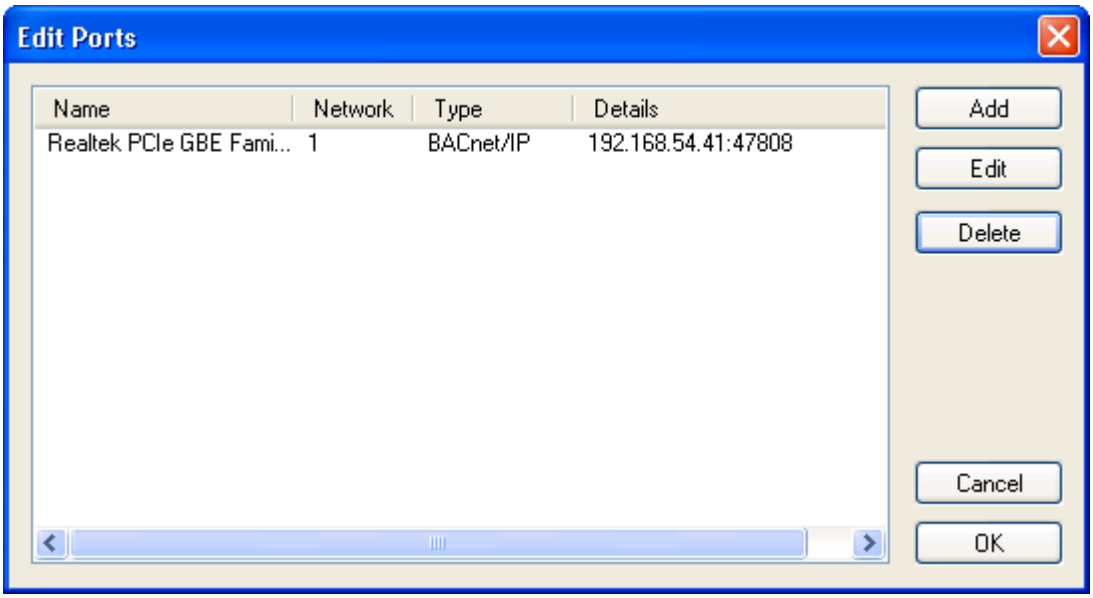
Tutorial

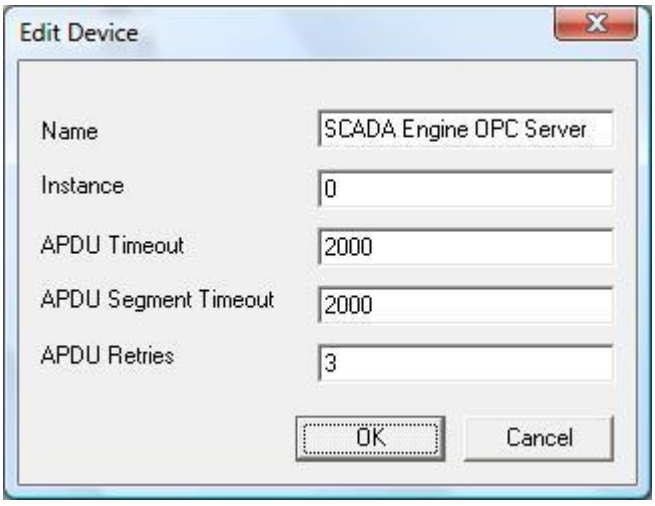
Step 1 - Configure Port

From the tools menu select Configure Port. The application will default to BACnet/IP configured on network 1. You may need to change the network number to suit your site.



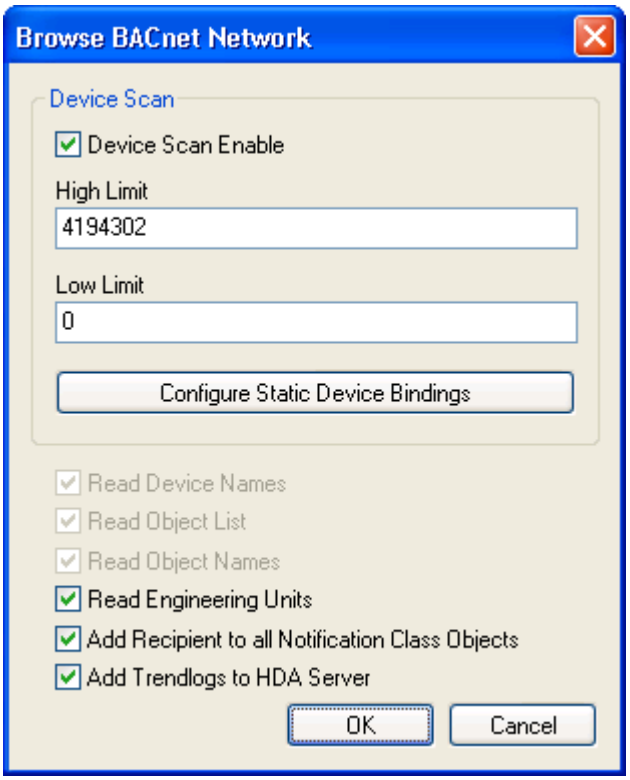
Step 2 - Configure Device

From the tools menu section select Configure Device. The application will default to device instance 0 and is the ID of the BACnet OPC server. This should be changed to a new device instance when used on site. Each device on the BACnet network number needs a unique device instance. The BACnet installer will give you a device instance to use, in this example we will use instance 200. You can leave the other options as their default values.



Step 3 - Browse BACnet Network

You are now ready to Browse the BACnet Network and automatically create OPC Tags, from Edit menu select "Browse BACnet Network" and this will bring up the following dialog box. You can unselect some of the items if you don't need to perform these functions. Select OK to start scanning the BACnet network.



The Device Scan Enable item will scan the BACnet network to locate devices if checked and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

If you know the Device ID that you would like to add OPC Tags for, then you can set the High and Low Limits to correspond to the device. This will reduce the time taken to locate the device.

The Read Device Names checkbox will read the Object Name from each device and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

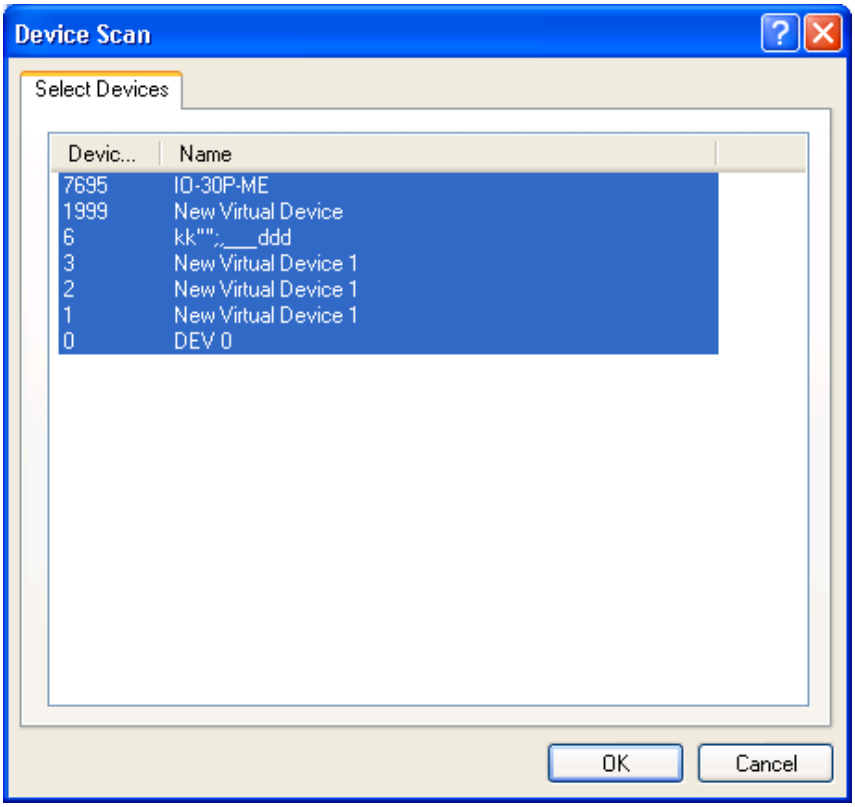
The Read Object Names checkbox will read the Object Name from each object in the device and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

The Read Engineering Units checkbox will read the Engineering Units from each device and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

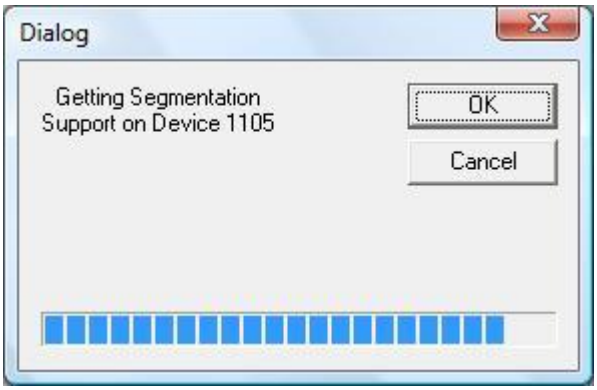
If the “Add Recipients to all Notification Class Objects” checkbox is checked then the OPC Server will add a recipient corresponding to the BACnet OPC Server to each notification class object on the network. Each Alarm generating device will then send an alarm or event to the SCADA Engine BACnet OPC Server. This is required if the AE or HDA operation of the SCADA Engine BACnet OPC Server is required.

If the “Add Trend logs to HDA Server” option is checked then a HDA item will be created for each BACnet Trend log.

The OPC Server will scan all of the devices on the network and read the device names from each device. This can take several minutes on a large network. Once it has finished a dialog will be displayed with a list of available BACnet Devices on the Network. You can highlight the devices for which you want OPC Tags created for. Select OK after your selection has been made.

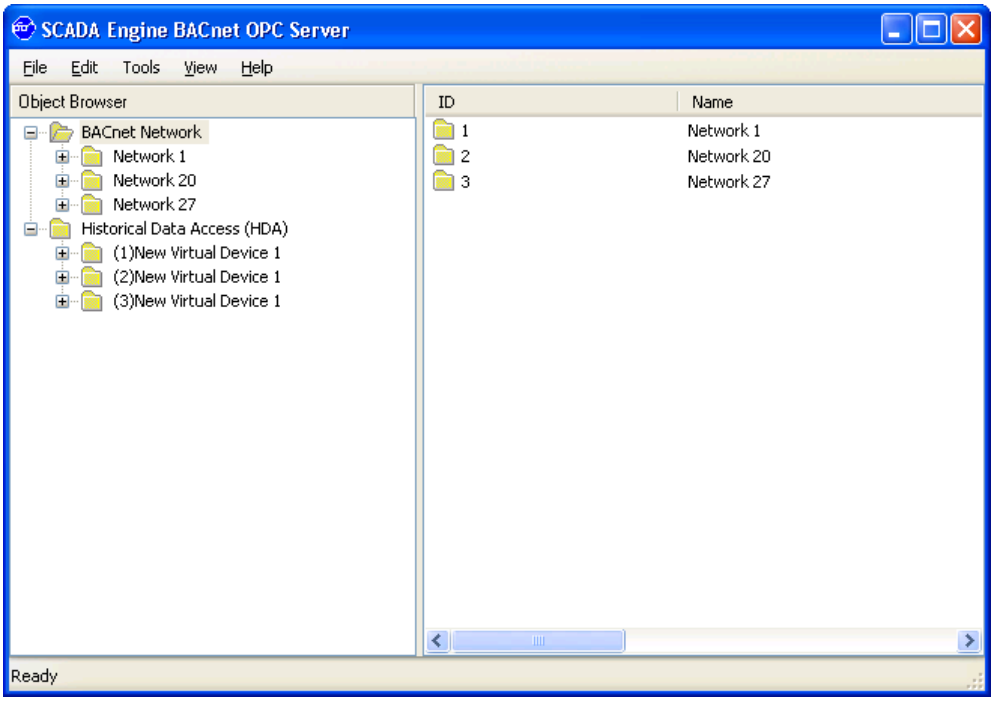


While the BACnet Server is building the OPC Tag list, you will see the following progress bar which indicates the status. It starts by reading the Object List from the device and then it builds up a list of OPC Tags based on the Names of the Objects inside the device. You can Cancel from this operation at any time and the BACnet Server will add the Objects located up to that point. If you Browse a second time, the BACnet Server will start from the last object it was reading.



Step 4 - View the Real Time Data

After the OPC Tags have been built, the explorer will be populated with the OPC Tag list. The OPC Tags are grouped in the same format as the BACnet Network which groups points by Device - Object Type - Object Name. When you navigate to the list of names, the BACnet OPC server will display real time data as shown below.



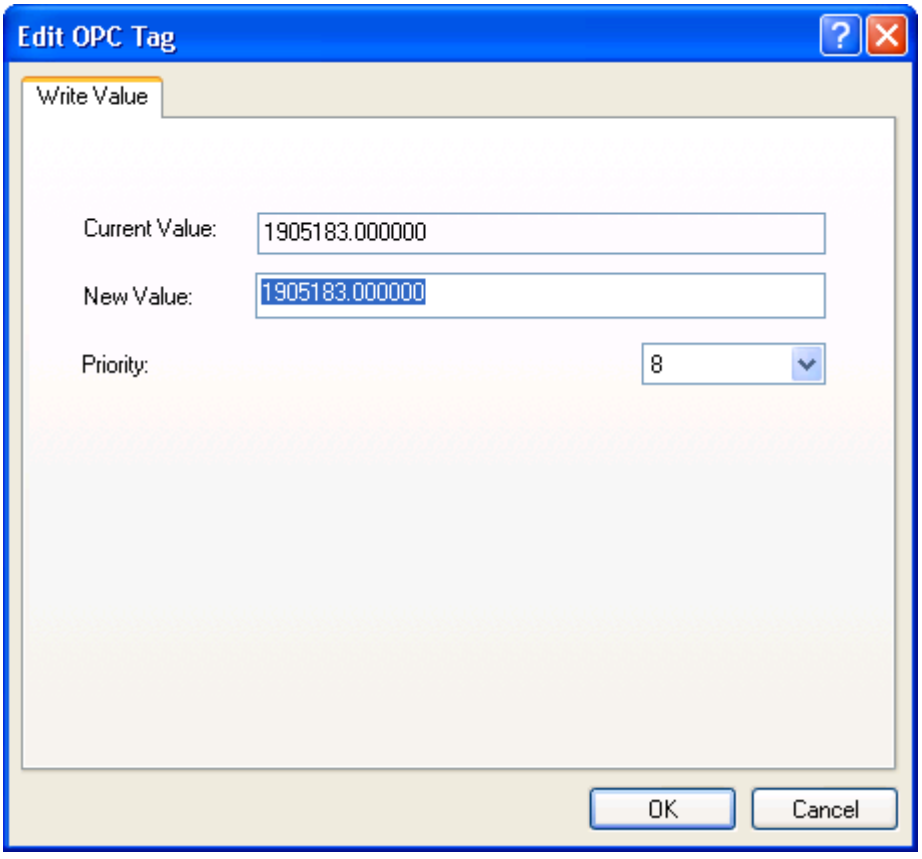
User Interface

The SCADA Engine BACnet OPC Server has an explorer style user interface which displays BACnet Objects and Trend logs in a tree view and list view. At the top of the tree is the “BACnet Network” with device groups underneath this. Device Groups are a way of grouping devices together in a logical fashion. Under the Device Group are all of the devices within that group, then object types within a device, object instances and the properties.

When the Object Properties are displayed, a complete list of properties for that object are displayed. The “all” property is used to get this information, but some devices do not support this feature. When this occurs the list of properties will be a list of required properties only.

Write Property

From the user interface, any property can be written to by double clicking on the property in the list view to bring up the write property dialog as shown below.



The current value is displayed and the new value is displayed beneath this. The write priority is enabled if the present value property has been selected and is writable. When writing to the present value property, it can be released by writing the value “null”

When the value is changed and the OK button is pressed the value will be written to the device using a BACnet write property request.

Logging

A log file is created in the directory of C:\Documents and Settings\All Users\Application Data\SCADA Engine\BACnet OPC Server<USER>\Log directory for Windows 2000, 2003 and XP or C:\ProgramData\SCADA Engine\BACnet OPC Server <USER>\Log for Vista or Windows 7.

The log file is configured to display ERROR and Information messages, but it can also be used to collect debug information by editing the file C:\Program Files\SCADA Engine\BACnet OPC Server\BACnetOPCServerUI.config. To change the logging level to debug, replace the line:

<priority value="INFO"/>

With:

<priority value="DEBUG"/>

Similar log files are created for the OPC Server service, and the HDA Server service.

Configuration

This section contains a detailed guide to all of the configuration options available in the SCADA Engine BACnet OPC Server.

Edit Ports

A port is a connection to the BACnet network and can be one of several different types including BACnet Ethernet, BACnet/IP, BACnet MSTP and BACnet PTP. Each of these port types can be considered as a different driver, two BACnet devices that are physically connected to each other need to be using the same communication type such as BACnet/IP.

BACnet has the ability to combine all of the different communication types on the same network through the use of routers. Most BACnet sites will have a combination of BACnet/IP devices and BACnet MSTP devices. The most common configuration for the BACnet OPC server will be using 1 single BACnet/IP port; any BACnet MSTP devices will be accessible through the BACnet routers.

The ports can be configured by selecting the **Tools - Configure Port** from the menu which will bring up the following Dialog Box.

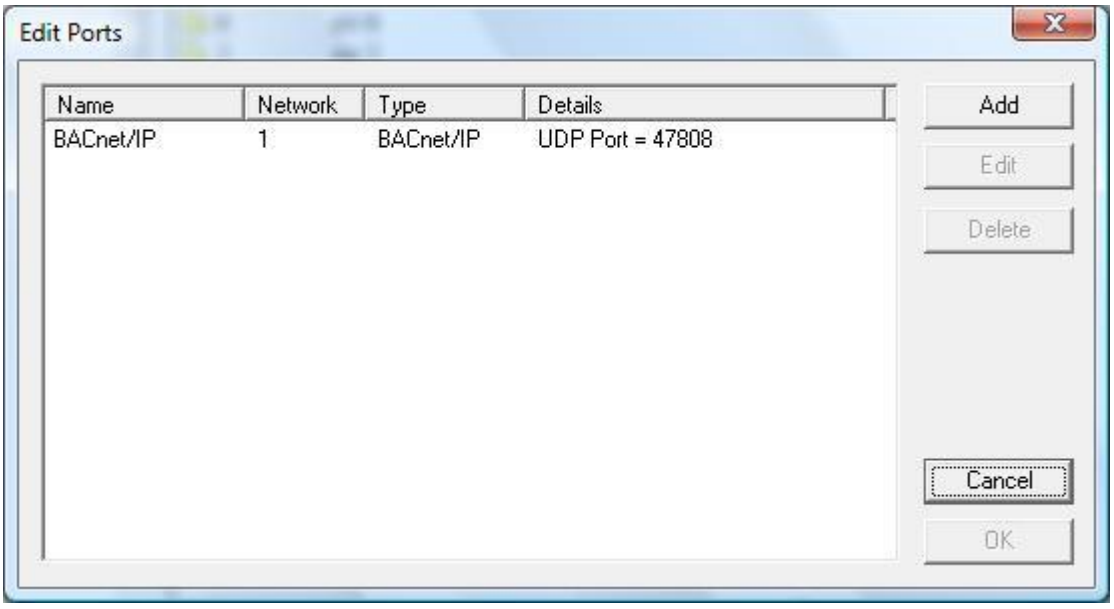


Figure 3 - Edit Ports Dialog

Here you will see a list of ports, which normally will contain only 1 entry for BACnet/IP. Each port needs to be assigned to a unique Network Number that corresponds to the network number used on site. A network number can be considered to be a physical connection between 1 or more devices, devices on different networks are accessible only via a router that connects the two networks together.

To edit a port, double click on the port in the list box, or highlight the port and select Edit. This will bring up an Edit port Dialog with one of the following types:-

- BACnet Ethernet
- BACnet/IP
- BACnet MSTP
- BACnet PTP

New ports can be added by select the Add Button.

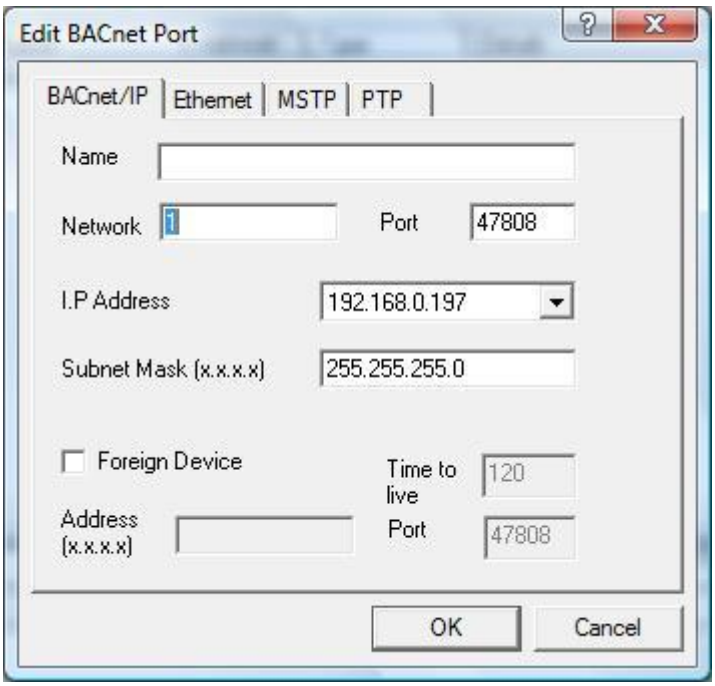
A Port can be deleted by highlighting the port and selecting the Delete Button.

The List box contains the following columns.

- The network name is for descriptive purposes only; you can use the name to give the port a description.
- The network field contains a Number between 1 and 65534 that Uniquely Identifies the network.
- The type field is one of four types:- IP, Ethernet, MSTP or PTP
- The details field contains a summary of the port parameters.

BACnet/IP Port

BACnet/IP is the most common connection to the BACnet Network, and in order to connect to the network you should consult the BACnet Installer to determine which UDP Port is being used and the Network Number. Be aware that **BACnet Ethernet is different to BACnet/IP.** Many installers do not realize that most BACnet devices can be configured to use either BACnet Ethernet or BACnet/IP and often do not identify which one is being used. BACnet/IP was introduced after BACnet Ethernet and is often referred to as Anex J. Both protocols operate over an Ethernet connection, however all devices must be configured to use the same protocol.

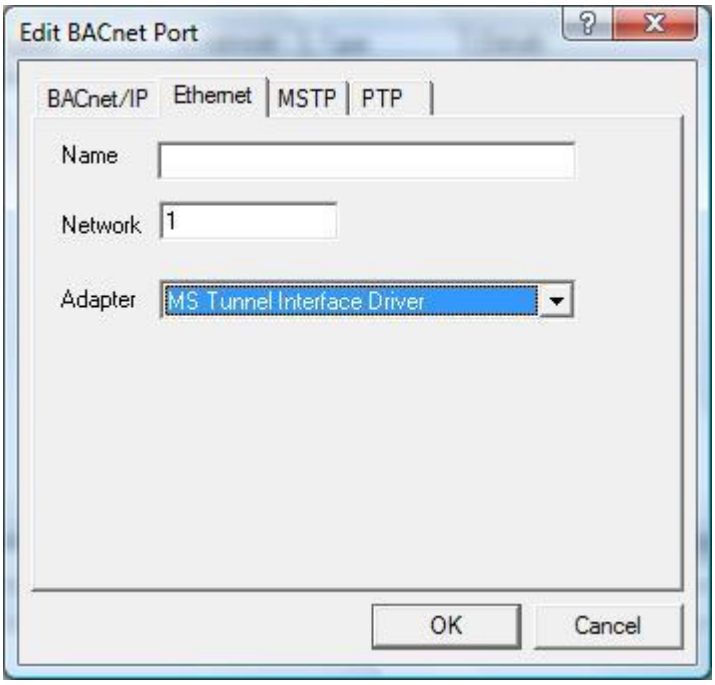

Edit BACnet Port
BACnet/IP
Ethernet
MSTP
PTP
Name
Network
1
Port
47808
I.P Address
192.168.0.197
Subnet Mask (x.x.x.x)
255.255.255.0
Foreign Device
Time to live
120
Address (x.x.x.x)
Port
47808
OK
Cancel

The BACnet Port dialog has the following parameters available for configuration.

- Name: The network name is for descriptive purposes only; you can use the name to give the port a description.
- Network: The network field contains a Number between 1 and 65534 that Uniquely Identifies the network.
- Port: This identifies the UDP Port used by BACnet, the default value is 47808 (BAC0).
- Foreign Device: When this box is ticked, the BACnet OPC Server will act as a foreign device and can be connected to a BBMD. This option is available if the BACnet OPC Server is not located on the same IP subnet as the other BACnet devices.
- Time To Live: This option is available only when the Foreign Device Tickbox has been selected. It is used by the BACnet OPC Server when registering as a foreign device.
- Address: This option is available only when the Foreign Device Tickbox has been selected. This is the Address of the BBMD.
- Port: This option is available only when the Foreign Device Tickbox has been selected. This is the port number of the BBMD.

BACnet Ethernet Port

BACnet Ethernet connects directly to the Ethernet network and does not use TCP/UDP, you will need to ask the BACnet installer for the network number that is being used. Be aware that **BACnet Ethernet is different to BACnet/IP.** Many installers do not realize that most BACnet devices can be configured to use either BACnet Ethernet or BACnet/IP and often do not identify which one is being used. BACnet/IP was introduced after BACnet Ethernet and is often referred to as Anex J. Both protocols operate over an Ethernet connection, however all devices must be configured to use the same protocol.

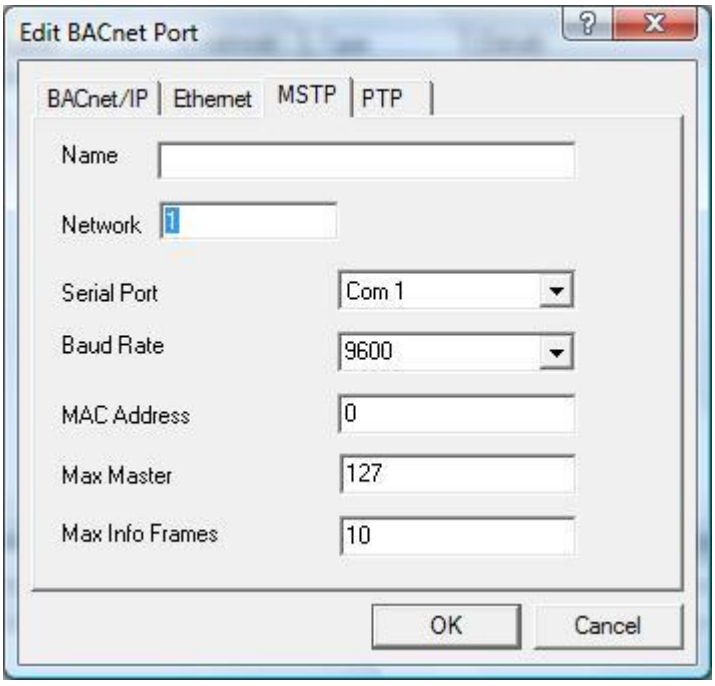


The BACnet Ethernet dialog has the following parameters available for configuration.

- Name: The network name is for descriptive purposes only; you can use the name to give the port a description.
- Network: The network field contains a Number between 1 and 65534 that Uniquely Identifies the network.
- Adapter: A list of Ethernet Adapters identifies which ethernet adapter will be used to connect to the network.

BACnet MSTP Port

BACnet MSTP is used by most field devices. The field devices are in turn connected to a global controller which acts as a router from BACnet/IP to MSTP. In most cases it is not necessary to connect directly to the MSTP network. MSTP operates over RS485 which means an RS485 card would need to be purchased in order to use this driver. The RS232 port on a PC does not support the maximum Baud Rate of 76800, an RS485 card normally does support the higher baud rates.

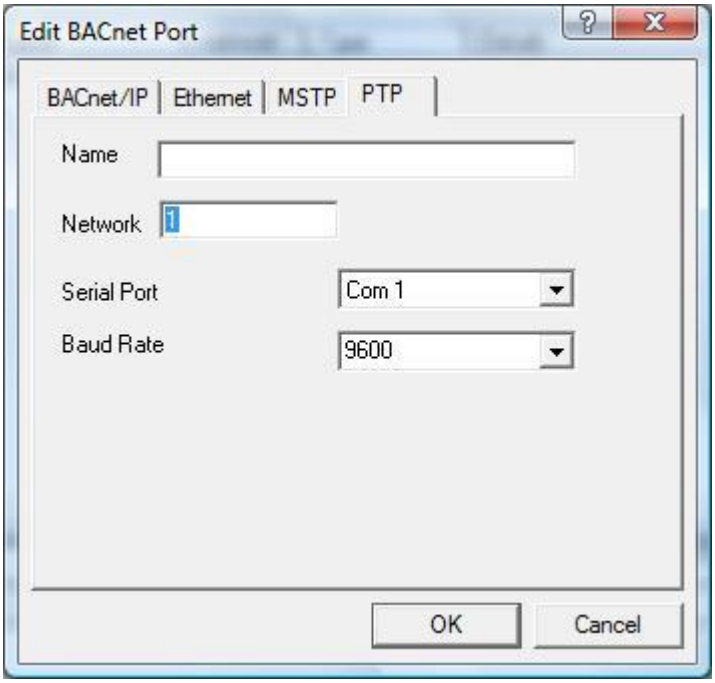


This dialog has the following parameters available for configuration.

- Name: The network name is for descriptive purposes only; you can use the name to give the port a description.
- Network: The network field contains a Number between 1 and 65534 that Uniquely Identifies the network.
- Serial: This is the Com Port Number
- Baud: This is the Baud Rate
- MAC Address: The MAC Address of the port in the range of 0 to 127.
- Max Master: The Maximum MAC Address on the Network in the range of 0 to 127, reducing this figure may result in increased performance..
- Max Info Frames: The number of frames to send before passing the token, enables a device to use more bandwidth.

BACnet PTP Port

BACnet PTP is typically used by remote workstations to dial up into a site via modems. It is the least reliable of connections and does not give the same performance as other types of connections.



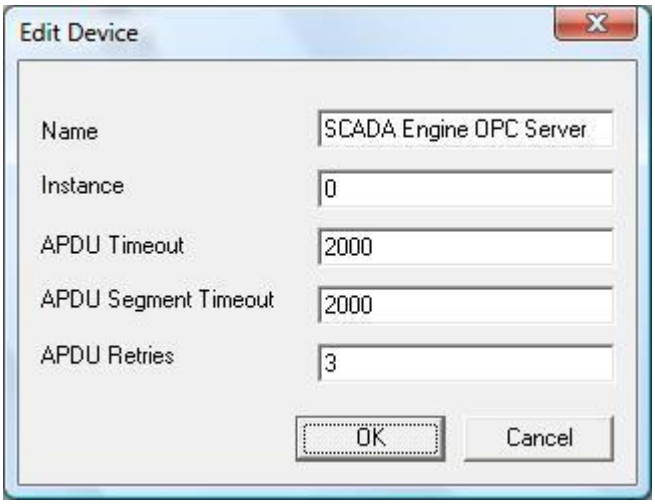
This dialog has the following parameters available for configuration.

- Name: The network name is for descriptive purposes only, you can use the name to give the port a description.
- Network: The network field contains a Number between 1 and 65534 that Uniquely Identifies the network.
- Serial: This is the Com Port Number
- Baud: This is the Baud Rate

Device Settings

The BACnet OPC Server acts as a BACnet device and requires a unique Device ID. You should consult the BACnet Installer for a Device ID.

To change the Device Settings, select Tools - Configure Device from the menu and the following Dialog Box will appear.



The following items in the dialog box can be edited.

- Name: The Name Field can be used to change the Object Name in the Device Object of the BACnet OPC Server.
- Instance: This is the Device ID of the BACnet OPC Server, each Device requires a unique device ID on the BACnet network. The default stting is 0. The accepted range is 0 to 4194303.
- APDU Timeout: This is the time the driver will wait for an expected response from the device before retrying or going on to the next request. The default setting is 500 milliseconds. The accepted range is 300 to 30000 milliseconds
- APDU Segment Timeout: This is the time the driver will wait for an expected response from the device before retrying or going on to the next request. The default setting is 500 milliseconds. The accepted range is 300 to 30000 milliseconds
- APDU Retries: The retry attempts setting determines the number of times the driver will retry a confirmed request before giving up. The default setting is 3 retries. The accepted range is 0 to 5.

OPC Tags

This section describes all of the configuration options available for the OPC Tags.

Automatic Tag Creation

The SCADA Engine BACnet OPC Server supports the automatic creation of OPC Tags by using BACnet Services to discover device ID's and Names.

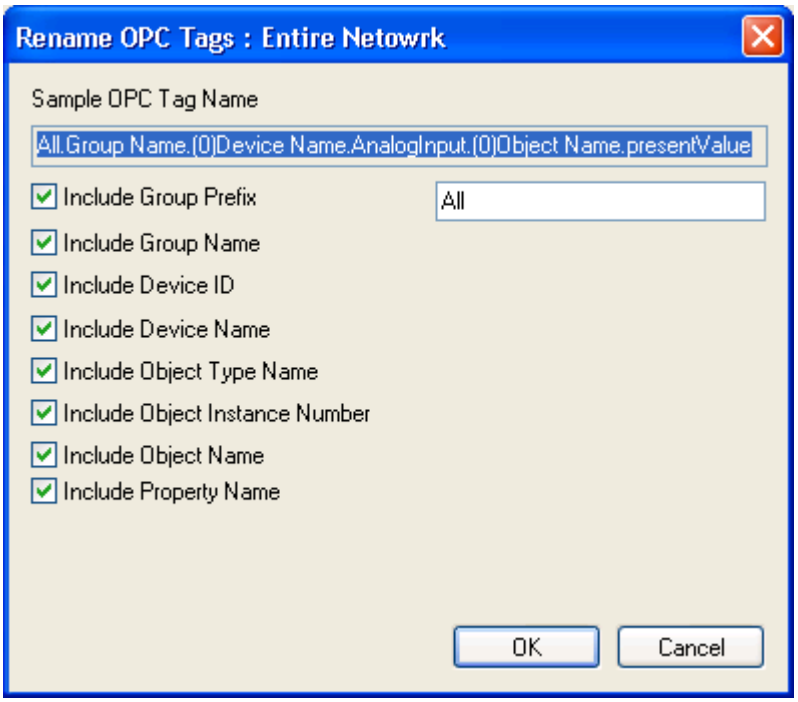
The Naming convention is configurable and it can be built up from the following fields:-

- GROUP NAME is used to describe device groups. By default the OPC Server will group devices based on the network number. The group name can be changed and devices can be moved from one group to another.
- DEVICE ID is the instance number of the device
- DEVICE NAME is the name of the device
- OBJECT TYPE is the type of object
- OBJECT INSTANCE is the instance number of the object
- OBJECT NAME is the name of the object.
- PROPERTY NAME is the name of the property

For example a complete OPC Tag name might be:

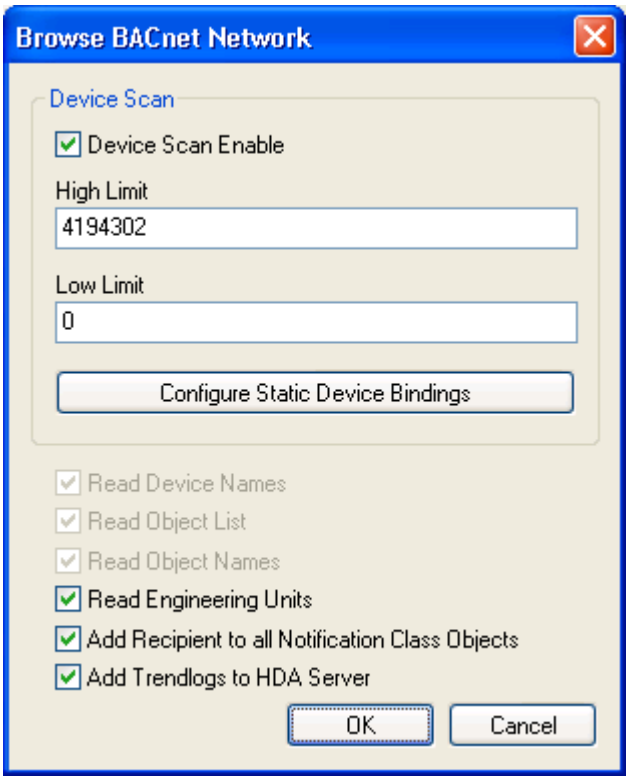
All.Group Name.(0)Device Name.AnalogInput.(0)Object Name.presentValue

To Rename the OPC Tags, select Rename OPC Tags from the edit menu to bring up the following dialog box.



Browse BACnet Network

From the edit menu select "Edit - Browse BACnet Network" and this will bring up the following dialog box. You can unselect some of the items if you don't need to perform these functions. Select OK to start scanning the BACnet network.



The Device Scan Enable item will scan the BACnet network to locate devices if checked and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

If you know the Device ID that you would like to add OPC Tags for, then you can set the High and Low Limits to correspond to the device. This will reduce the time taken to locate the device.

The Read Device Names checkbox will read the Object Name from each device and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

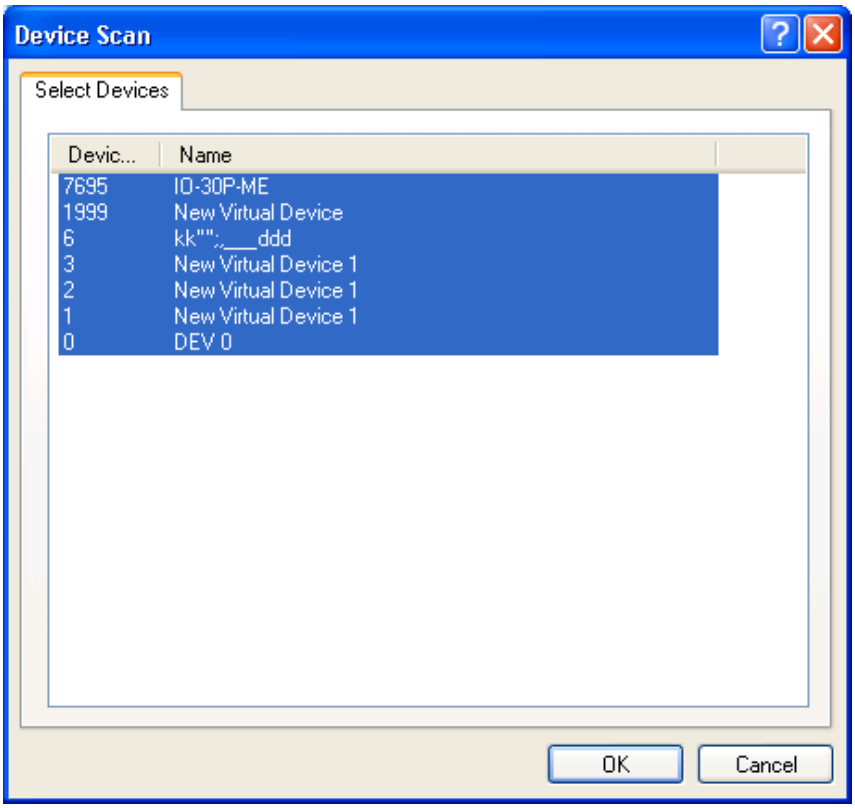
The Read Object Names checkbox will read the Object Name from each object in the device and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

The Read Engineering Units checkbox will read the Engineering Units from each device and it can take several minutes on a large network. You may decide to uncheck this item if you need to perform this function a second time.

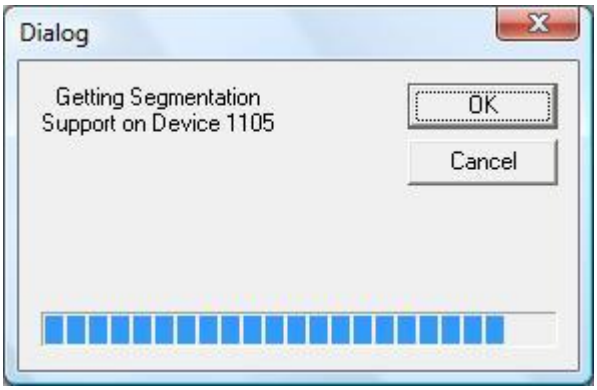
If the “Add Recipients to all Notification Class Objects” checkbox is checked then the OPC Server will add a recipient corresponding to the BACnet OPC Server to each notification class object on the network. Each Alarm generating device will then send an alarm or event to the SCADA Engine BACnet OPC Server. This is required if the AE or HDA operation of the SCADA Engine BACnet OPC Server is required.

If the “Add Trend logs to HDA Server” option is checked then a HDA item will be created for each BACnet Trend log.

The OPC Server will scan all of the devices on the network and read the device names from each device. This can take several minutes on a large network. Once it has finished a dialog will be displayed with a list of available BACnet Devices on the Network. You can highlight the devices for which you want OPC Tags created for.

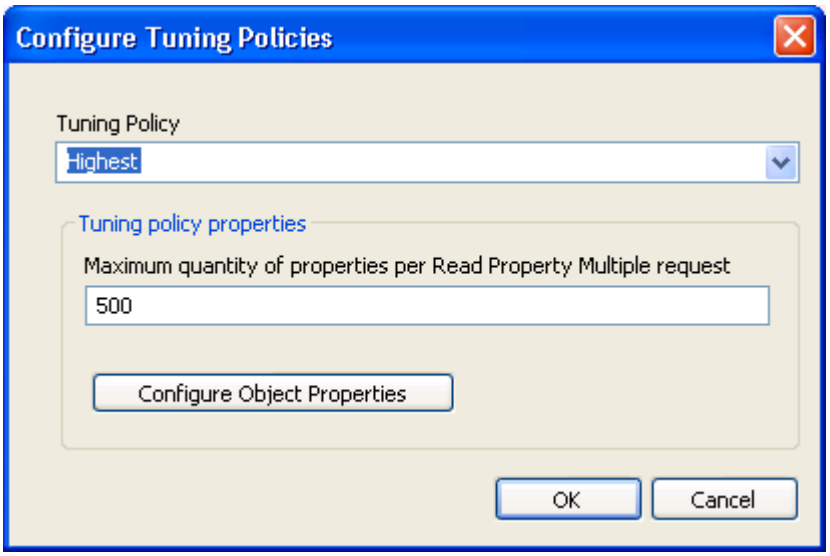


While the BACnet Server is building the OPC Tag list, you will see the following progress bar which indicates the status. It starts by reading the Object List from the device and then it builds up a list of OPC Tags based on the Names of the Objects inside the device. You can Cancel from this operation at any time and the BACnet Server will add the Objects located up to that point. If you Browse a second time, the BACnet Server will start from the last object it was reading.



Tuning Policies

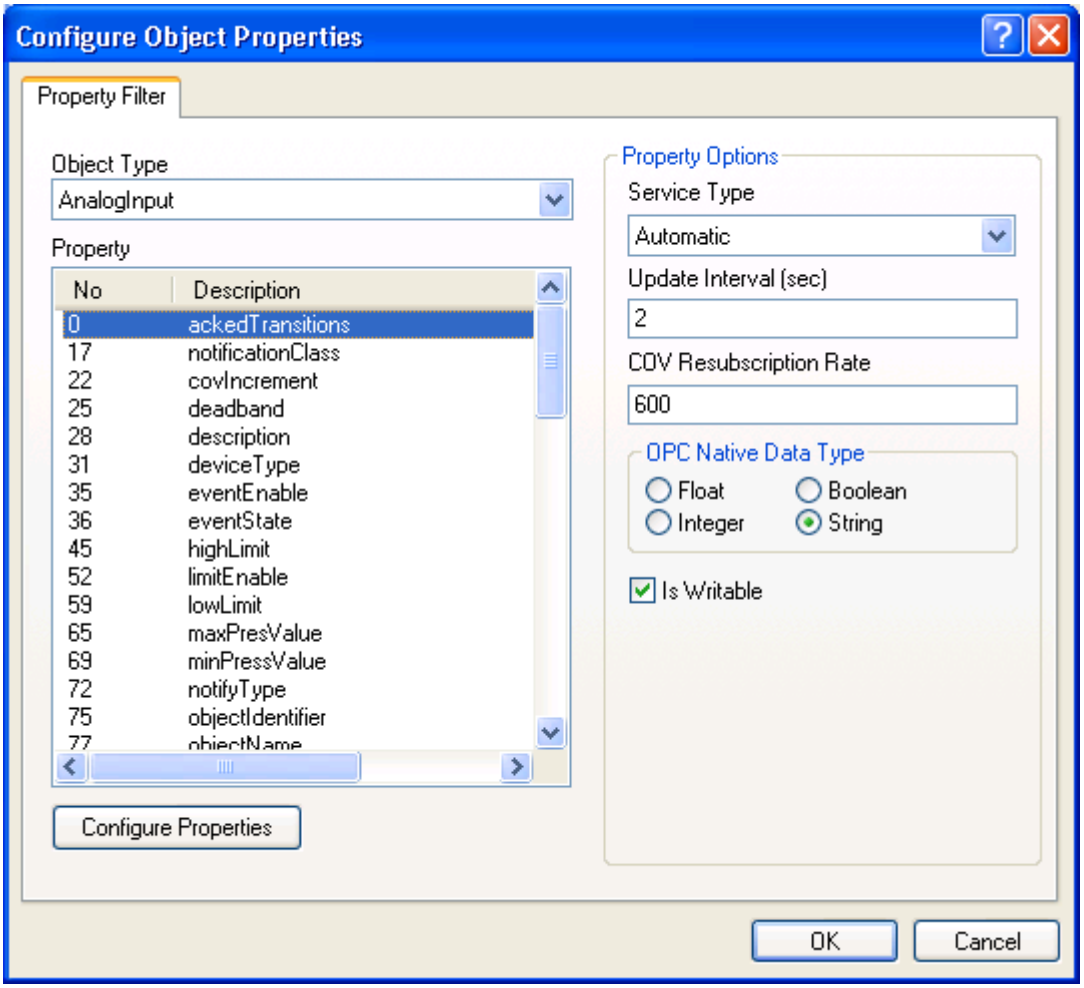
The BACnet OPC Server has 4 configurable tuning policies where the scan rate, service type, update rate and resubscription interval can be selected for each property type. Each device is configured to use 1 of the tuning policies. The tuning policies can be changed from the menu option Tools – Configure Tuning Policies. This will bring up the following dialog box. From this screen you can select the tuning policy you wish to edit and then change the Maximum Number of properties to fetch in a readPropertyMultiple request.



Configure Object Properties

The BACnet OPC Server uses a configurable list of Object Types and Properties when Automatically Creating the OPC Tag Database. You can use the filter options to define the names of proprietary objects and properties.

To configure the objects and properties click on the "Configure Object Properties" button from the Configure Tuning Policies dialog box to bring up the form below.



For each object type a list of properties will be listed, when a property is highlighted the property options for that property will be updated.

Service Type

The Service Type can be readPoperty, readPropertyMultiple, ConfirmedCOV or UnconfirmedCOV. If readProperty or readPropertyMultiple is used then the data is polled using the update interval as the time between successive polls. If Confirmed or Unconfirmed COV notifications are used then a subscribeCOV notification is sent and the data is updated when a COV notification is received.

Update Interval

If readProperty or ReadPropertyMultiple services are used then the OPC Server will poll for the data using the update interval setting as the time between successive requests.

COV Resubscription Interval

The COV resubscription interval is the time between sending another BACnet Subscribe COV service. This setting is used only when COV's are used to update the value.

OPC Native Data Type

This is the data type to use on the OPC side.

Is Writable

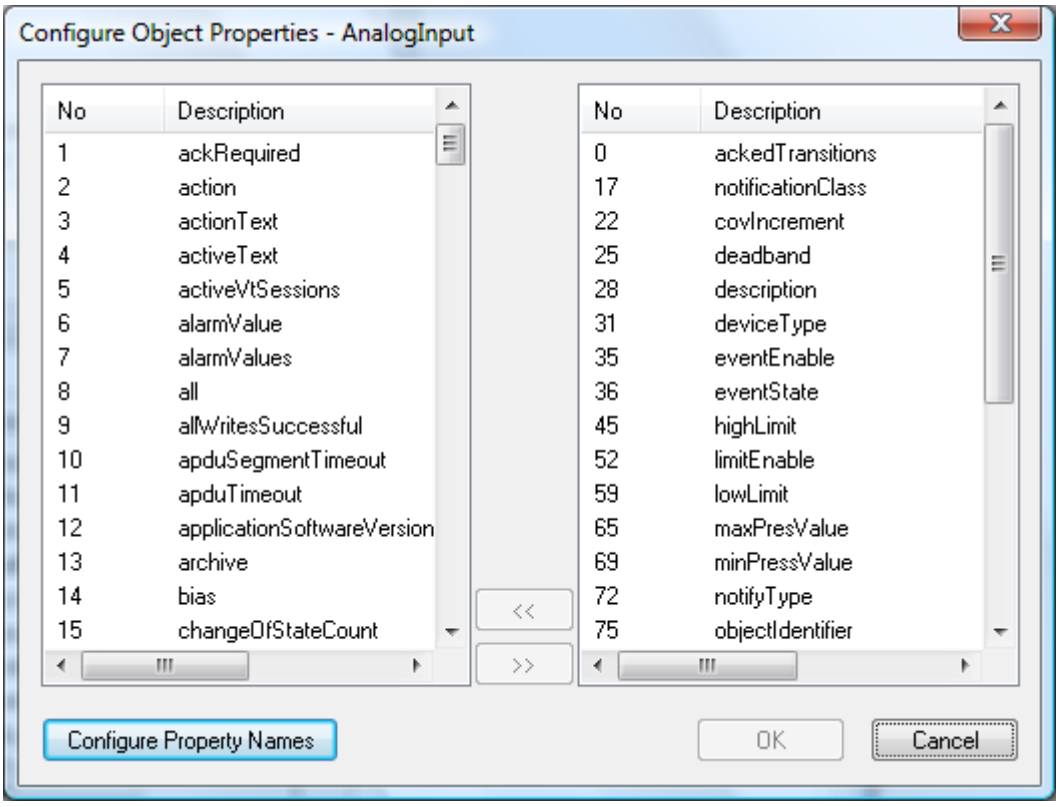
If this option is checked then the OPC Tag will be set to Is Writable.

Configure Properties

This option will bring up a dialog box to allow the properties to be configured for each object type. Each property has a corresponding enumeration number, the supplier of the BACnet device will be able to advise which properties and corresponding enumeration number is used on the device.

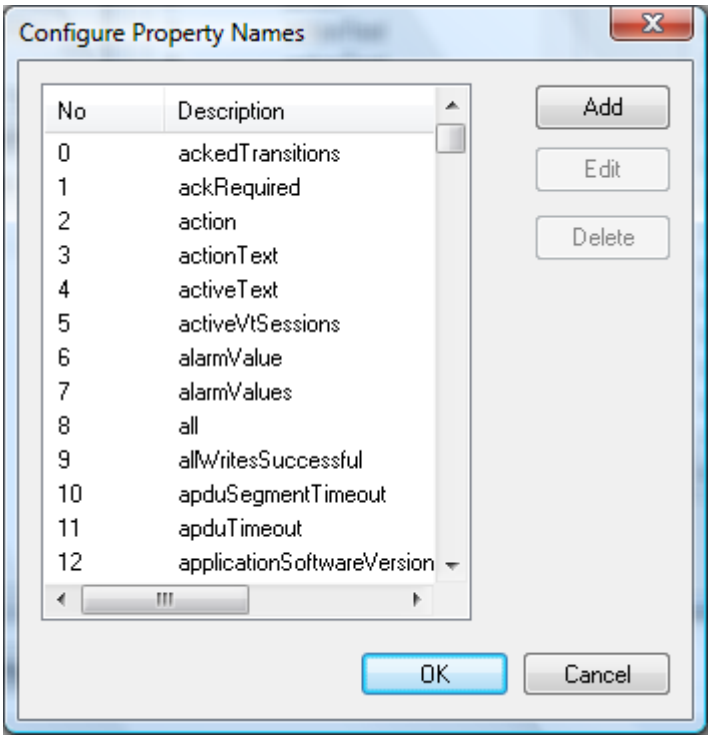
BACnet supports proprietary properties, and the SCADA Engine BACnet OPC Server allows for proprietary properties to be added to the list of standard properties for each object type.

Pressing the Configure Properties dialog box will display the following dialog box.

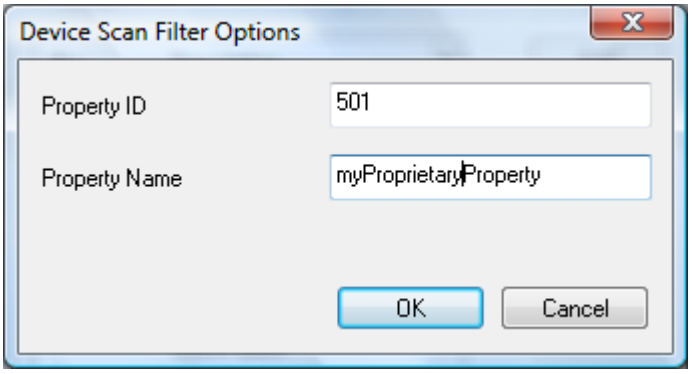


The left hand list box contains a list of available properties, while the right hand list box is a list of properties for the object. Properties can be added or removed from the object by selecting the arrow left or arrow right buttons.

The property names can be configured by selecting “Configure Property Names” to bring up the following dialog box.



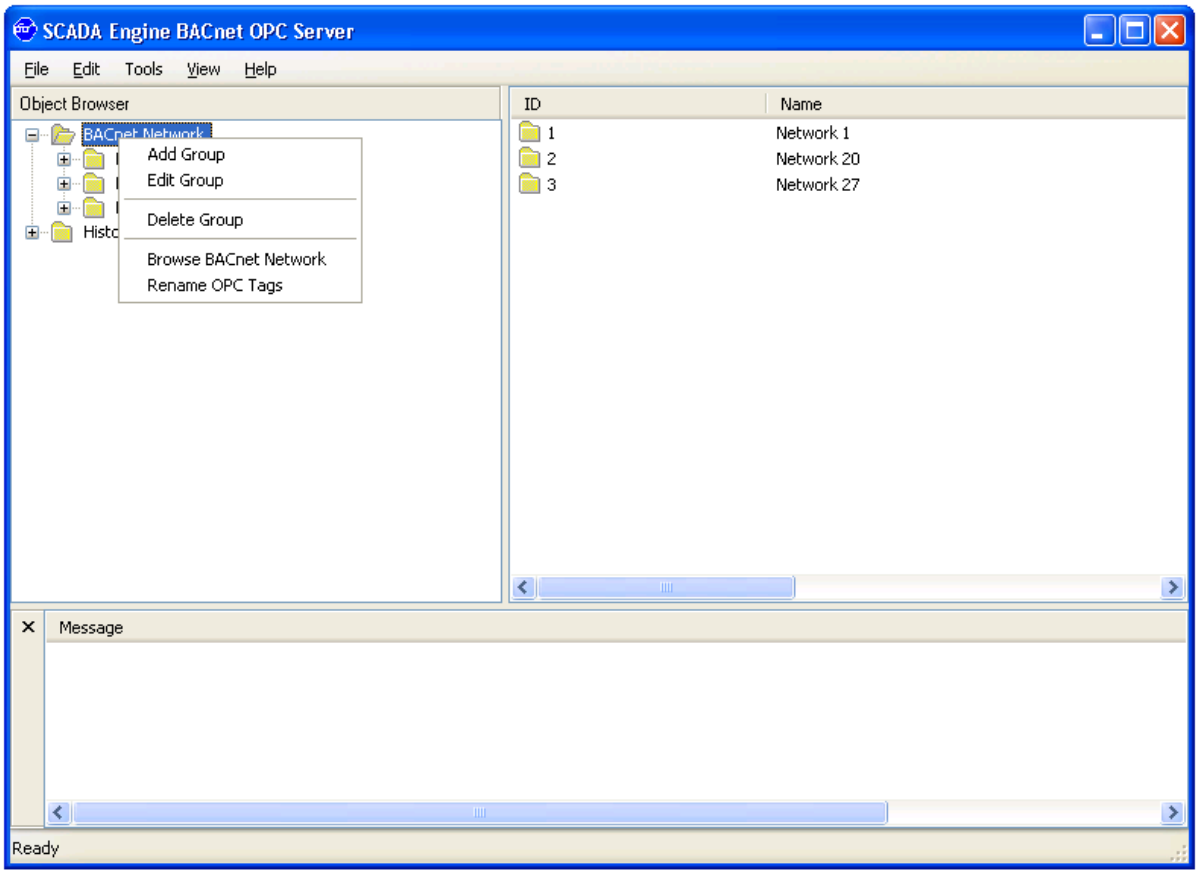
The list box contains a complete list of properties and proprietary properties, which can be extended by selecting the Add button. To add a proprietary property, the enumeration number and name must be entered. As shown below.



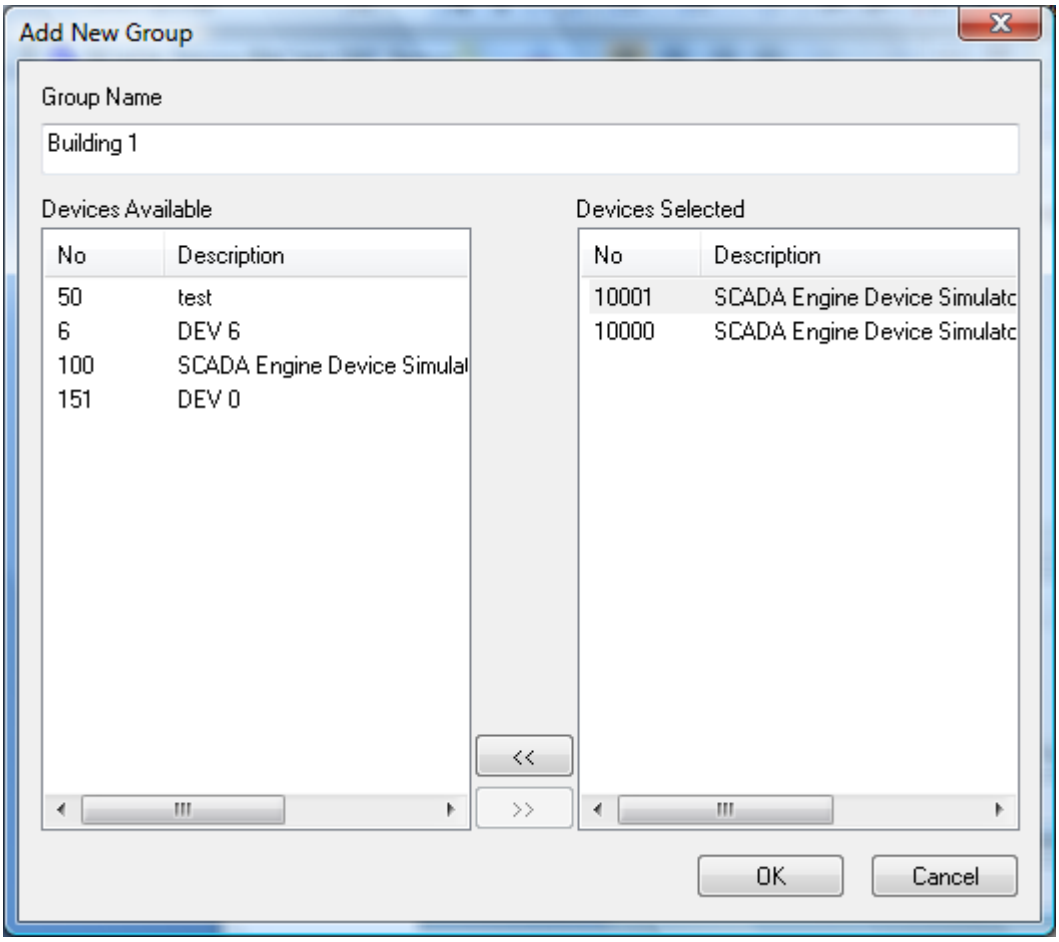
Device Groups

Device Groups provide a way to group devices into the OPC Tag hierarchy. The Device Group name can be added to the OPC Tag Name to provide an extra level in the tag hierarchy. This makes it easier for the engineer to determine the location of the OPC Tag.

This is useful on large sites where there may by many devices. A typical grouping may be for building 1 and building 2. Each building may have 2 devices in it. To make this grouping, right click on the "BACnet Network" item of the tree view as shown below.



Select “Add Device Group” from the popup menu and add the devices that belong to this group as shown below. Select Ok when done.



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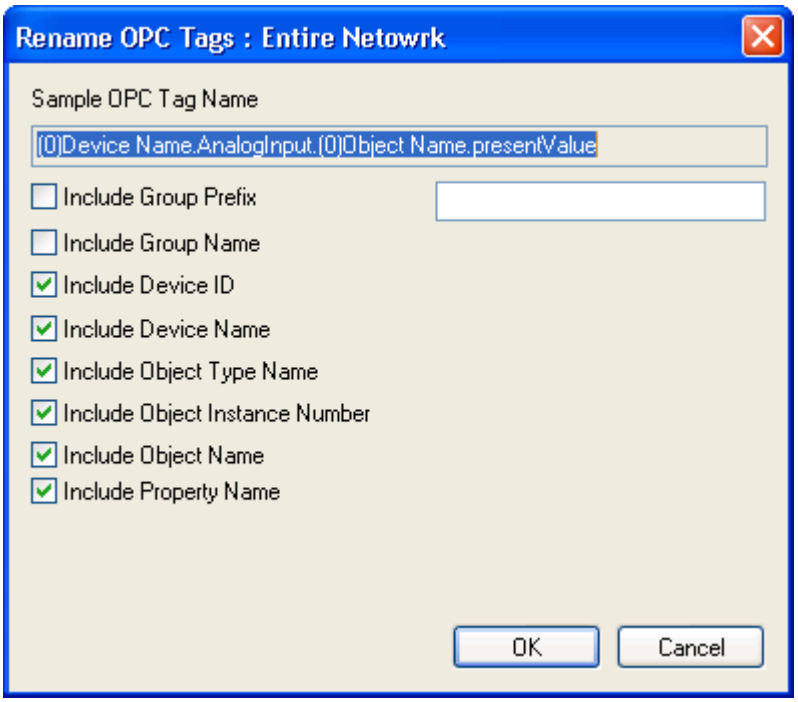
Rename OPC Tags

The OPC Tag Names can be renamed to use a configurable naming convention. To do this right click on the “BACnet Network” or “Device Group” for which you want to rename tags for. This will bring up the Rename Tags dialog as shown below.



Using the Check boxes you can select which items are to be included in the OPC Tag name. Select OK when done and all of the tags will be renamed to follow the convention you have specified.

This option may be required if you decide to add device groups and regroup the devices.

Writing to the Present Value

BACnet Outputs and Value Objects can be commanded using a write priority between 1 and 16 where 16 is the least significant. If commands have been issued at different priorities then the command at the lower priority is used to control the present value. The command values are stored in a property called the priority Array which contains 16 values corresponding to a write at a priority between 1 and 16.

For example there is an analog output which has not been written to with a write property request and it has a value under automatic control of 70. A write is made to this object with a value of 50 at priority 16. It's present value will become 50 and the priority Array at index 16 will have a value of 50, all other values in the priority array will be null. If a second write of 20 is made at priority 10, then the present value will be set to 20 and the priority array at index 10 will be 20.

The commanded values can be released by writing a NULL at the priority to be released.

To do this with the SCADA Engine BACnet OPC Server, the string "NULL" must be sent as the write value.

Naming Conventions

BACnet Arrays

BACnet data may be an array data type and a single element can be referenced from an OPC Client by adding a colon, property, colon and then the index number after the OPC Tag name as shown below.

<OPC Tag Name>:<Array Index>

For example to read index 8 from the priority array of OPC Tag All.New Group.(1) Hello.(1) AnalogOutput.(0) My New Object.(87) priorityArray, the following Tag name would be used:-

All.New Group.(1) Hello.(1) AnalogOutput.(0) My New Object.(87) priorityArray:8

Write Priority

When writing to the present value object, the default write priority would be used. In some instances it may be required to write using a different write priority. This can be done by adding a colon and the write priority to the OPC Tag Name as follows.

<OPC Tag Name>:<Write Priority>

For example to write to the present value using write priority of OPC Tag All.New Group.(1) Hello.(1) AnalogOutput.(0) My New Object.(85) presentValue, the following Tag name would be used:-

All.New Group.(1) Hello.(1) AnalogOutput.(0) My New Object.(85) presentValue: 8

Complex Data Types

The SCADA Engine BACnet OPC Server supports reading and writing of complex data points. The complex data is represented as a string. A complex data type is enclosed by a brace {}, so the time value data type is represented as {09:00 0.00,9,1} where 09:00 0.00 is the time and 9,1 is the value where 9 corresponds to an enumerated data type. For this example the complex data represents On at 9:00 am.

Each array or list element is enclosed by a brace, so {{09:00 0.00,9,1}} is an element of a list of time values. Each array or list is enclosed by a brace and the items within are separated by a comma, so the Time Values array is {{{09:00 0.00,9,1}},{{17:00 0.00,9,0}}}} which represents On at 9:00 am Off at 5:00 pm.

The weekly schedule property of a time schedule object is an array of 7 Daily Schedules with each daily schedule corresponding to a day in the week. A daily schedule is a list of time values. The entire weekly schedule would be represented as {{{{{{09:00 0.00,9,1}},{{17:00 0.00,9,0}}}}},{{{}}},{{{}}},{{{}}},{{{}}},{{{}}},{{{}}}}

Display

A special data type for display type is available which will format the present value property of Analog, Binary and Multistate objects into a string.

For analog objects using the resolution property and unit properties are read from the device, the units are added after the value, while the resolution property is used to format the analog value to the correct number of digits.

For binary objects, the active and inactive texts are read and then used to display the value.

For multistate objects, the state text property is used to represent the value as a string.

OPC Alarm and Event (AE) Server

The SCADA Engine BACnet OPC Server incorporates an OPC Alarm and Event (AE) Server which will translate a BACnet Alarm into an OPC Alarm.

In BACnet Alarms are transmitted using the BACnet ConfirmedEventNotification and UnconfirmedEventNotification services. Each Alarm transmitting device needs to be configured to send alarms to the SCADA Engine BACnet OPC Server. Once the alarms are received an OPC alarm is sent to all OPC Clients that have subscribed for alarms. The message text from the BACnet device is sent to the OPC Client.

Event Categories

The OPC Server has 2 Event Categories for System Alarms and BACnet Alarms. System Alarms are OPC Simple Events and they transfer system events from the OPC Server. BACnet Alarms are configured as Conditional Events and are generated by a BACnet Confirmed or Unconfirmed Event Notification.

Condition Names

The Condition Names correspond to the BACnet Notify Type :-

- Alarm
- Event

Sub Condition Names

The Condition Names correspond to the BACnet Event States :-

- Normal
- Fault
- OffNormal
- HighLimit
- LowLimit
- LifeSafetyAlarm

OPC Source field

The OPC Source field is taken from the corresponding OPC Tag in the OPC Server if it exists. If no corresponding tag is found then the OPC Server will construct a source name using the Device ID, Object Type and Instance of the BACnet Event.

OPC Message field

The OPC Message field is taken from the message field of the BACnet Alarm, if no message exists then this field will be empty.

BACnet Alarm Acknowledgement

The OPC Server supports BACnet Alarm Acknowledgement, if an Acknowledgement is required then the OPC Server will generate an OPC Alarm with the AckRequired flag set to true. When an OPC Client Acknowledges an Alarm the OPC Server Server will send a BACnet Acknowledge Service to the BACnet device. When the BACnet device receives the acknowledgement it will generate a BACnet Event Message with the Notify Type set to Acknowledge. This will generate an OPC Alarm with the message set to "Alarm Acknowledged".

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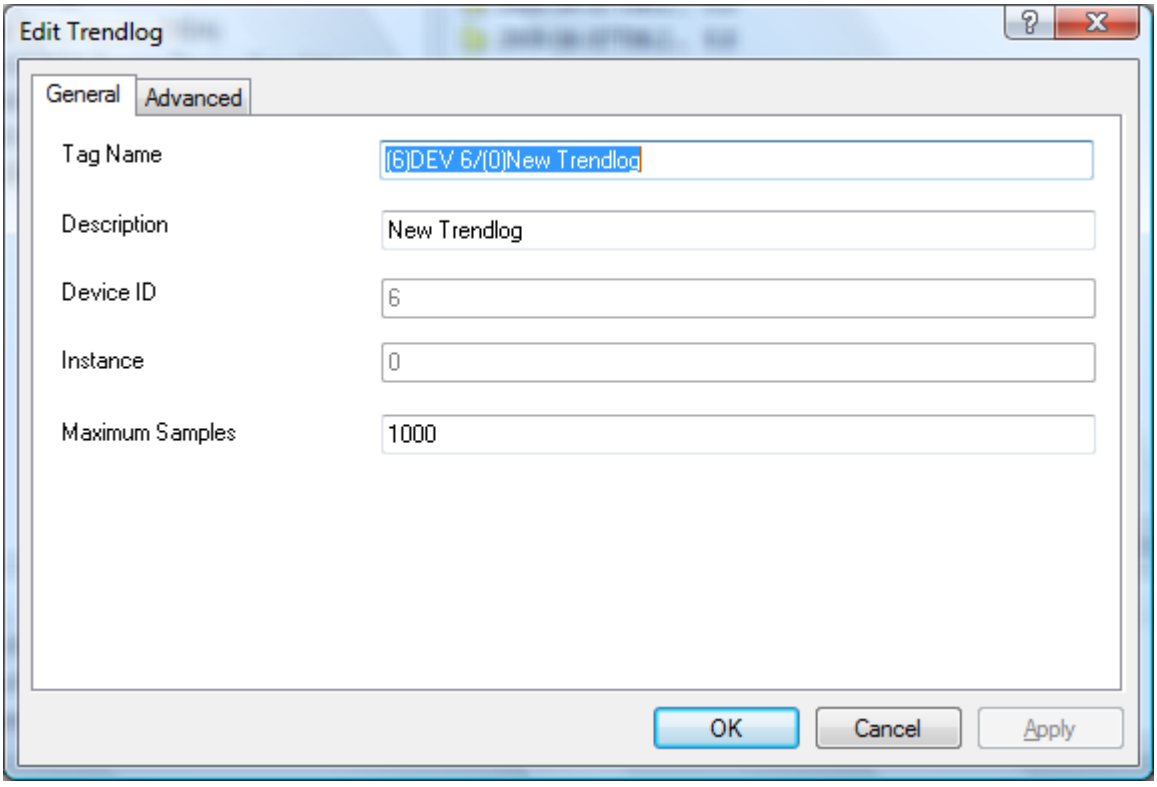
OPC Historical Data Access (HDA) Server

The SCADA Engine BACnet OPC Server incorporates a HDA Server running as a separate service. The HDA items are mapped to BACnet Trend log objects and the data is updated using the BACnet Read Range service. As part of the automatic OPC Tag creation HDA Items will be created from BACnet Trend log objects.

Edit Trend log

You can edit a BACnet Trend log by right clicking an item on the tree view to bring up the following dialog.



Tag Name

The Tag name is the name that is displayed from an OPC Client.

Description

The description is the title of the trend log that will appear in an OPC Client

Device ID

This is the BACnet device ID for the BACnet Trend log object.

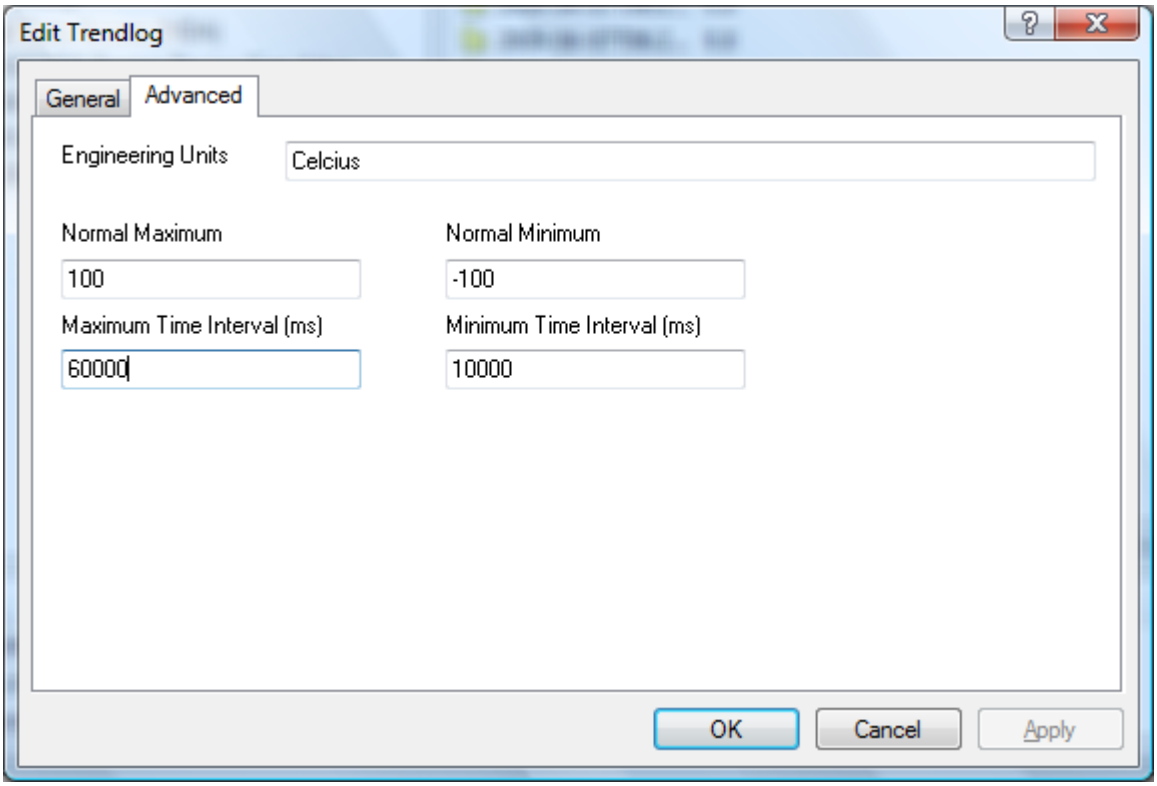
Instance

This is the BACnet object instance number for the BACnet Trend log object.

Maximum Samples

This is the maximum number of samples that will be held in the offline database of the BACnet OPC Server.

The Advanced tab has some additional settings for the trend log object as shown by the figure below.



Engineering Units

The engineering units of the trend log.

Normal Maximum

This is the maximum normal value.

Normal Minimum

This is the Minimum normal value.

Maximum Time Interval

This is the maximum time interval.

Minimum Time Interval

This is the minimum time interval.

Description of operation

During the Device Discovery phase, the BACnet OPC Server performs the following functions.

1. Send out BACnet whoIs Services to discover each and every BACnet Device on the network.
2. Read all devices names.
3. Read the list of objects from every device.
4. Read all object names
5. Read all properties from each object type in every device.
6. Store the object data into the database.

The OPC namespace can be very large on a BACnet System because each property is represented as an OPC tag. For example a BACnet network with 100 devices each with 100 objects with 10 properties per object will produce an OPC namespace of 100,000 OPC tags.

The BACnet OPC Server does not load the namespace into memory. Data is loaded on demand when requested by an OPC Client and then unloaded after a client has finished requesting the data. This helps to reduce the network traffic as well as the resources required by the OPC Server. When no OPC Clients are connected, the OPC Server will make periodic requests for the status of each device on the network, otherwise no network traffic occurs. When an OPC Client connects to the BACnet OPC Server and subscribes to an OPC Tag, the OPC Server will start to collect data for that tag.

The installer should be aware that when more points subscribed by an OPC Client, the network traffic will increase accordingly.

Upgrading from older versions

Previous versions of the BACnet OPC Server stored each OPC tag name into a CSV file called OPC_Tags.csv which was loaded into memory each time the OPC Server was started. It is possible to import the CSV file into the new version of the BACnet OPC Server in order to retain the OPC Tag names. After importing the CSV file, it is no longer used by the BACnet OPC Server. If the CSV file is not used, then the names of the OPC tags in the new version will not match the old version and the OPC Client may need some reengineering.

In order to upgrade from previous versions of the BACnet OPC Server, the configuration files should first be backed up. The files to backup located are located in the folder “C:\Program Files\SCADA Engine\BACnet OPC Server”. All .csv files should be backed up and placed in a new location.

Once all of the files have been backed up, install the new version of the OPC Server onto the PC. During the installation you will be asked to remove the previous version of the OPC Server.

Start the BACnet OPC Server and then select the file – import menu. From this menu you can import the tables for the following items :-

1. Engineering Units. This csv file is stored in a file called engineering_units.csv and it contains a list of names for each of the BACnet Engineering Units.
2. Object Types. This csv file is stored in a file called object_types.csv and contains a list of object type names. Proprietary objects can be given real names by editing this csv file.
3. Property Types. This csv file is stored in a file called property_types.csv and contains a list of property names. Proprietary properties can be given real names by editing this csv file.

Once these tables have been imported, the OPC_Tags.csv file can be imported. The site will now contain an OPC Tag Namespace with tag names that correspond to the previous version of the BACnet OPC Server. It will also contain a full list of all BACnet properties.

Backout strategy

If for any reason the upgrade is not successful, the new version can be uninstalled and the previous version installed. The OPC_Tags.csv file can be reloaded into the previous version.

Trouble Shooting

Server does not start

The most common error that may occur is that the SCADA Engine BACnet OPC Server cannot start up because another application is already running. When this happens you will see the following error message in the Message Window:-

- Error in BACnet Server could not start driver - Only one usage of each socket address (protocol/network address/port) is normally permitted.

This may happen if you are running the Cimetrics BACnet stack, or any other software that uses BACnet port 47808. In this case you will need to disable the Cimetrics BACnet stack which can be done from services in the control panel, or shut down the other BACnet application.

Unable to see other BACnet devices

Confirm that all devices on the network are using the same protocol type and are connected correctly to the network.

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BACnet Protocol Implementation Conformance Statement

Product

Product	Model Number	Protocol Revision	Software Version	Firmware Version
SCADA Engine BACnet Server API	SE-BSDKDB-WIN SE-BSDKDB-LIN	135-2004 Version 1 Revision 4	2.0.20	2.0.20

Date Tested: 31 March 2009

Vendor Information

SCADA Engine
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www.scadaengine.com

Product Description

The SCADA Engine BACnet Server API is a software toolset which can be used to build a BACnet Server or

BACnet Operator Workstation.

BACnet Standardized Device Profile

Product	Device Profile	Tested
SE-BSDKDB-WIN	BACnet Application Specific Controller (B-ASC) BACnet Operator Workstation (B-OWS)	
SE-BSDKDB-LIN	BACnet Application Specific Controller (B-ASC) BACnet Operator Workstation (B-OWS)	

Supported BIBBs

Product	Supported BIBBs	BIBB Name	
SE-BSDKDB-WIN SE-BSDKDB-LIN	DS-RP-A	Data Sharing-ReadProperty-A	
	DS-RP-B	Data Sharing-ReadProperty-B	
	DS-RPM-A	Data Sharing-ReadPropertyMultiple-A	
	DS-RPM-B	Data Sharing-ReadPropertyMultiple-B	
	DS-WP-A	Data Sharing-WriteProperty-A	
	DS-WP-B	Data Sharing-WriteProperty-B	
	DS-WPM-A	Data Sharing-WritePropertyMultiple-A	
	DS-WPM-B	Data Sharing-WritePropertyMultiple-B	
	DS-COV-A	Data Sharing-COV-A	
	DS-COV-B	Data Sharing-COV-B	
	DS-COVP-A	Data Sharing-COVP-A	
	DS-COVP-B	Data Sharing-COVP-B	
	DS-COVU-A	Data Sharing-COV-Unsolicited-A	
	DS-COVU-B	Data Sharing-COV-Unsolicited-B	
	SCHED-A	Scheduling-A	
	SCHED-I-B	Scheduling-Internal-B	
	SCHED-E-B	Scheduling-External-A	
	T-VMT-A	Trending-Viewing and Modifying Trends-A	
	T-VMT-I-B	Trending-Viewing and Modifying Trends-Internal-B	
	T-VMT-E-B	Trending-Viewing and Modifying Trends-External-B	
	T-ATR-A	Trending-Automated Trend Retrieval-A	

Product	Supported BIBBs	BIBB Name	
	T-ATR-B	Trending-Automated Trend Retrieval-B	
	NM-CE-A	Network Management-Connection Establishment-A	
	NM-CE-B	Network Management-Connection Establishment-B	
	AE-N-A	Alarm and Event-Notification-A	
	AE-N-I-B	Alarm and Event-Notification Internal-B	
	AE-N-E-B	Alarm and Event-Notification External-B	
	AE-ACK-A	Alarm and Event-ACK-A	
	AE-ACK-B	Alarm and Event-ACK-B	
	AE-ASUM-A	Alarm and Event-Alarm Summary-A	
	AE-ASUM-B	Alarm and Event-Alarm Summary-B	
	AE-ESUM-A	Alarm and Event-Enrollment Summary-A	
	AE-ESUM-B	Alarm and Event-Enrollment Summary-B	
	AE-INFO-A	Alarm and Event-Information-A	
	AE-INFO-B	Alarm and Event-Information-B	
	AE-LS-A	Alarm and Event-LifeSafety-A	
	AE-LS-B	Alarm and Event-LifeSafety-B	
	DM-RD-A	Device Management-ReinitializeDevice-A	
	DM-RD-B	Device Management-ReinitializeDevice-B	
	DM-DDB-A	Device Management-Dynamic Device Binding-A	
	DM-DDB-B	Device Management-Dynamic Device Binding-B	
	DM-DOB-A	Device Management-Dynamic Object Binding-A	

Product	Supported BIBBs	BIBB Name	
	DM-DOB-B	Device Management-Dynamic Object Binding-B	
	DM-DCC-A	Device Management-DeviceCommunicationControl-A	
	DM-DCC-B	Device Management-DeviceCommunicationControl-B	
	DM-PT-A	Device Management-Private Transfer-A	
	DM-PT-B	Device Management-Private Transfer-B	
	DM-TM-A	Device Management-Text Message-A	
	DM-TM-B	Device Management-Text Message-B	
	DM-TS-A	Device Management-TimeSynchronization-A	
	DM-TS-B	Device Management-TimeSynchronization-B	
	DM-UTC-A	Device Management-UTCTimeSynchronization-A	
	DM-UTC-B	Device Management-UTCTimeSynchronization-B	
	DM-LM-A	Device Management-List Manipulation-A	
	DM-LM-B	Device Management-List Manipulation-B	
	DM-OCD-A	Device Management-Object Creation and Deletion-A	
	DM-OCD-B	Device Management- Object Creation and Deletion -B	

Standard Object Types Supported

Product	Object Type	Creatable	Deletable	Tested
SE-BSDKDB-WIN SE-BSDKDB-LIN	Analog Input	Yes	Yes	
	Analog Output	Yes	Yes	
	Analog Value	Yes	Yes	
	Binary Input	Yes	Yes	
	Binary Output	Yes	Yes	
	Binary Value	Yes	Yes	
	Calendar	Yes	Yes	
	Device	No	No	
	Event Enrollment	Yes	Yes	
	File	Yes	Yes	
	Loop	Yes	Yes	
	Multi-state Value	Yes	Yes	
	Notification Class	Yes	Yes	
	Program	Yes	Yes	
	Schedule	Yes	Yes	
	Trend Log	Yes	Yes	
	LifeSafetyPoint	Yes	Yes	
	LifeSafetyZone	Yes	Yes	
	Accumulator	Yes	Yes	
	PulseConverter	Yes	Yes	

Data Link Layer Options

Product	Data Link	Options	Tested
SE-BSDKDB-WIN SE-BSDKDB-LIN	BACnet/IP (Annex J)	Can communicate as a Direct BACnet/IP device. Can register as a Foreign BACnet/IP device.	
	Ethernet (ISO 8802-3)		
	MS/TP Master	9600, 19200, 38400, 76800	
	PTP		

Segmentation Capability

Product	Segmentation Type	Supported	Window Size (MS/TP product limited to 1)	Tested
SE-BSDKDB-WIN SE-BSDKDB-LIN	Able to transmit segmented messages	Yes	Configurable	
	Able to receive segmented messages	Yes	Configurable	

Device Address Binding

Product	Static Binding Supported	Tested
SE-BSDKDB-WIN SE-BSDKDB-LIN	Yes	

Networking Options

Product	Router Option	Options	Tested
SE-BSDKDB-WIN SE-BSDKDB-LIN	Router	Multiple BACnet/IP, Multiple Ethernet, Multiple MS/TP Multiple PTP	

Character Sets

Product	Character Sets supported	
SE-BSDKDB-WIN SE-BSDKDB-LIN	ANSI X3.4	
	IBM Microsoft DBCS	
	ISO 8859-1	